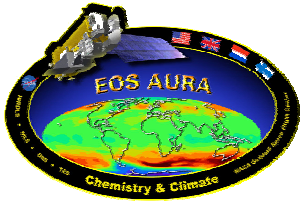
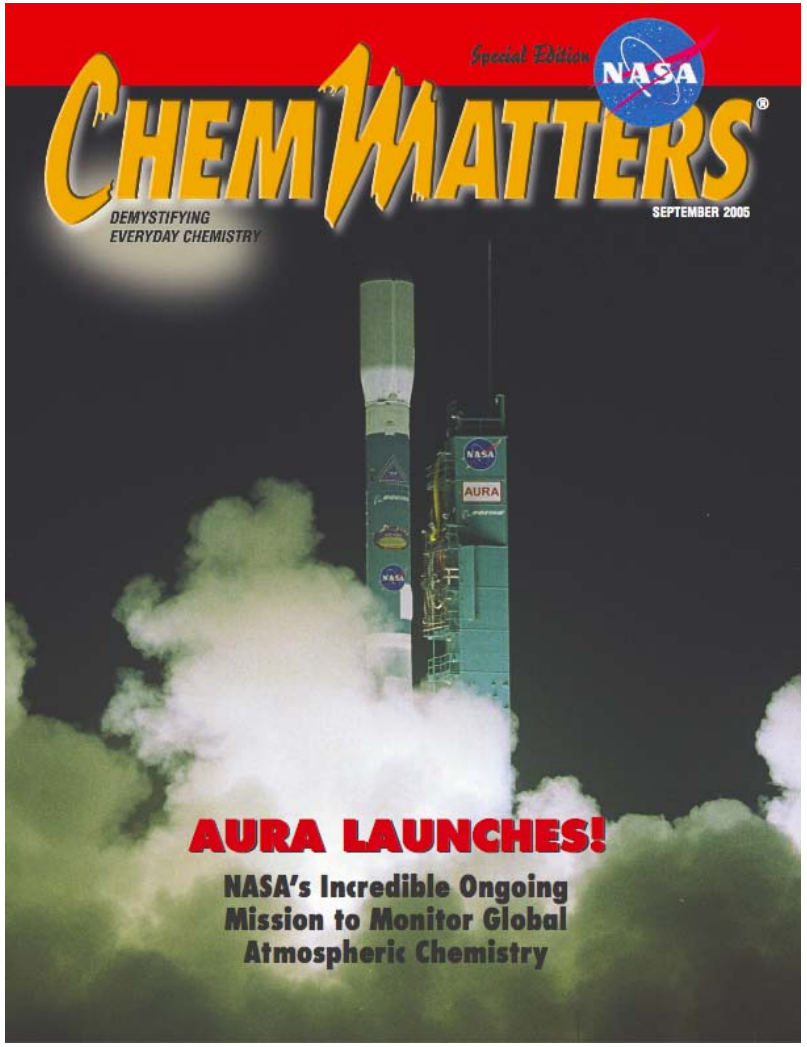
Aura EPO Working Group

- American Chemical Society
- GLOBE School Program and Teacher Workshops
- GLOBE Netherlands
- Ozone Monitoring Garden
- Smithsonian National Museum of Natural History
- Smaller Museum Programs
- FMI Direct Broadcast Products
- Other Post Launch Initiatives



Fourth issue of ChemMatters published September 2005 with the American Chemical Society

- How the Earth Got it's Aura.
- Flight of the WB-57.
- What's so Equal about Equilibrium
- Clearing the Air-Treaties to Treatments
- Student Gardens Monitor Air Quality



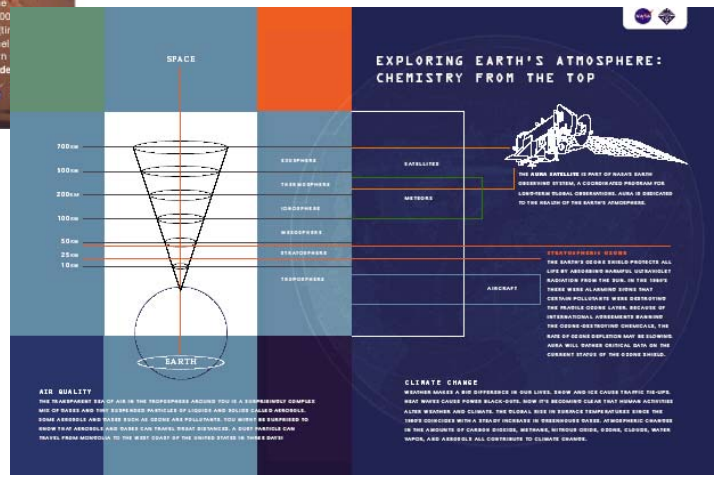
http://www.chemistry.org/portal/a/c/s/1/acsdisplay.html?DOC=education\curriculum\chemmatters\issue_arch.html

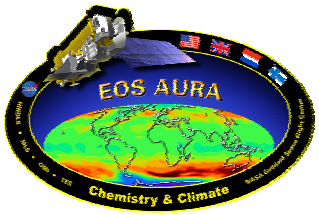
Aura Poster - Developed with the American Chemical Society

Passed NASA Earth Science Education Product Review

Possible inclusion in IPY packet

5000 posters available





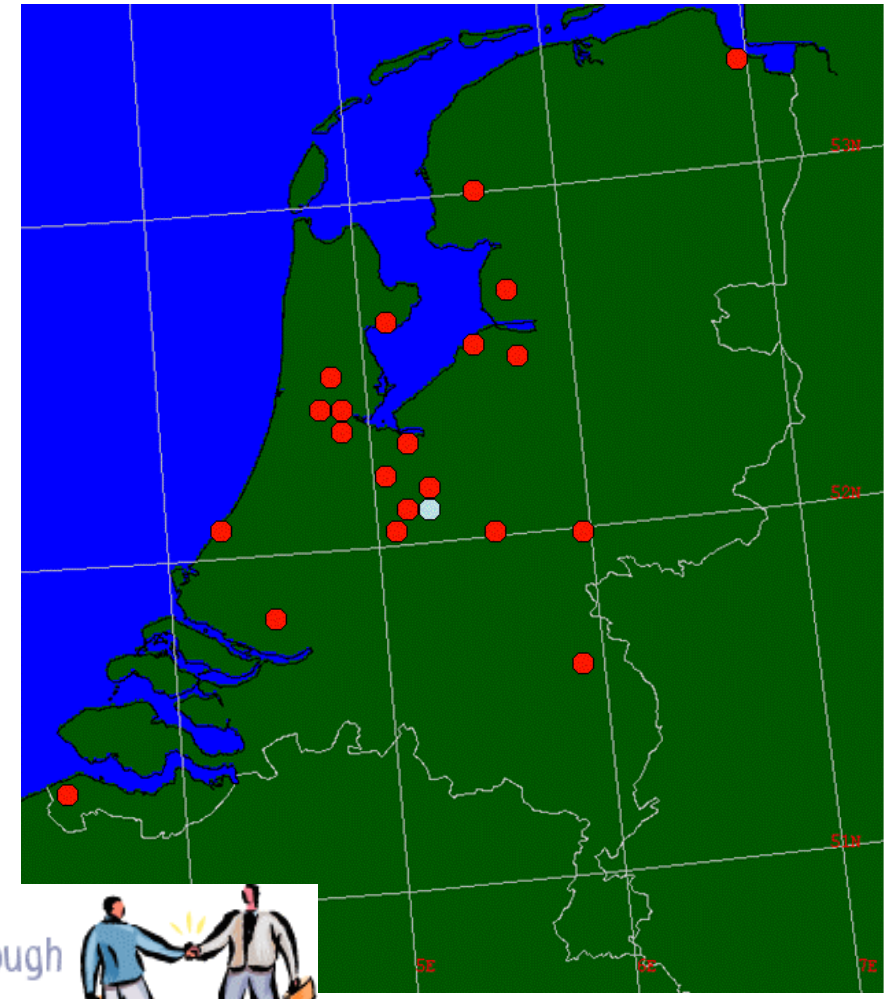
GLOBE Atmospheric Sciences Workshop for Teachers Summer 2006 and 2007

- 2006 workshop at GSFC for Goddard Education Staff August 29-30
- 2007 workshop at JPL hosted by Aura
- Participants will learn GLOBE protocols for surface ozone, aerosols, UV and clouds.
- Focus will be on NASA educators who work with NASA Explorer Schools
- Support for GLOBE Aerosols PI

GLOBE in the Netherlands

http://www.knmi.nl/globe/index_en.html

- **Aerosol monitoring project run by KNMI and the Foundation for Environmental Education (SME)**
- **Involves the validation of satellite AOT using a handheld sun photometer**
- **Featured in article on NASA Earth Observatory (http://earthobservatory.nasa.gov/Study/Partnerships/**



Enhancing Research and Education through Partnerships

by Jeannie Allen • design by Robert Simmon
January 25, 2005

GLOBE Netherlands-KNMI Partnership

New project scientist: Tim Vlemmix
New leader: Ellen Brinksma

Until Nov 1, 2005: Joris de Vroom & Folkert Boersma

Strong collaboration with D. Brooks, S. Stockman

Goals:

- **Outreach – get satellite research (OMI) and atmospheric research knowledge to schoolsGenerate publicity for OMI (press coverage of GLOBE events)**

- **Science validation of OMI aerosols (previously – MODIS)**
  School measurements provide potential for dense network that cannot be reached with professional Instruments (~30-40 locations compared to ~ 3-4?)

GLOBE Netherlands-KNMI Partnership

- Large increase of number of participating schools
- (now active <10, next years ~ 30 to 40)

- "Aerosols" module will be part of new curriculum (2007-2008)
  Note: Module was tested, very enthusiastic reactions.

- KNMI trains teachers to train students & use module

- SME coordinates GLOBE the Netherlands & organizes efforts

- Rework module to include OMI (was MODIS)

- Quality control of school measurements

- Use for OMI validation

National Aeronautics and Space Administration

THE OZONE MONITORING GARDEN

What is Ozone?

Ozone, or O_3 is a molecule that is made up of three oxygen atoms.

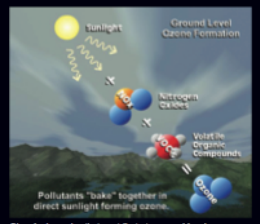
Where is Ozone?

Ozone is found in two places in the Earth's atmosphere. Ozone in the Earth's upper atmosphere (stratosphere) protects life from harmful ultraviolet (UV) rays from the sun. High concentrations of ozone found in the Earth's lower atmosphere (troposphere) are hazardous to life.

Mesosphere 50-80 km
Ozone Layer 25 km
Stratosphere 10-50 km
Troposphere 0-10 km

How is Tropospheric Ozone created?

Ozone in the lower atmosphere (troposphere) is created through a series of reactions involving man-made chemical species such as Nitrogen oxides (NO_x) and volatile organic compounds (VOCs).

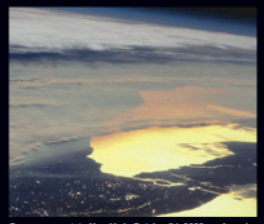


Chemical species that contribute to ground level ozone. Courtesy National Park Service.

Aura Ozone Monitoring Instrument (OMI) image of Nitrogen Dioxide Concentrations over the eastern United States on January 29, 2006.

How does it affect me?

In high concentrations, ground level ozone is toxic to human tissue. When ozone levels get too high, the EPA issues "Code Red" days, on which humans should limit their time outdoors.



Smog over upstate New York, October 21, 2000 as viewed by the astronauts from Shuttle STS-92. Courtesy NASA JSC.

How can I help?

You can help reduce the amount of ozone in the troposphere by taking some simple steps:

- Walk rather than take a car whenever possible
- Turn off appliances and lights when you leave the room
- Cut back on heating and air conditioning as much as you can

www.nasa.gov

Ozone Biomonitoring Garden At the Goddard Visitor Center

- Litho developed for 2006 Earth Science Week
- Website in Development
- Trained GSFC Education Staff
- Introduced to teachers during summer workshops
- SOS Air Quality presentation developed for visitors

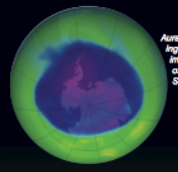
Aeronautics and Space Administration

THE OZONE MONITORING GARDEN

Why does NASA study ozone?

Aura is an Earth Observing Satellite (EOS) that monitors the chemistry, composition, and dynamics of the Earth's atmosphere. Aura scientists are using the spacecraft to answer three essential questions:

- Is the Stratospheric ozone layer recovering?
- What are the processes controlling air quality?
- How is Earth's climate changing?



Aura Ozone Monitoring Instrument (OMI) image of the 2005 ozone hole, taken September 11, 2005.

What does Goddard Space Flight Center have to do with Aura?

The EOS Aura satellite, instruments, launch, and science investigations are managed here at NASA's Goddard Space Flight Center. GSFC contributes to NASA's vision "to improve life here..." by using Aura to monitor the health of the atmosphere.

Why does NASA have an ozone garden?

NASA's work involves a great deal of research in the service of society on our own planet, including studies of air quality. The Ozone Garden helps to educate people about ozone in our atmosphere.

How can I monitor ozone in my own area?

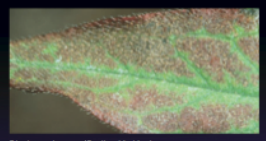
You can monitor ozone by planting ozone-sensitive species in your own garden.

The Aura Air Quality Garden at Goddard Space Flight Center's Visitor Center.

What does ozone damage look like?

When exposed to high levels of ozone, many plants show damage on their leaves. Older leaves have the most damage. Plants with ozone damage have very fine colored spots on the upper surfaces of their leaves, and some leaves also turn yellow.

Cut leaf coneflower (Rudbeckia laciniata)



Black-eyed susan (Rudbeckia hirta)

Where do I go for more information?

For more information, visit the following websites:

Aura Spacecraft:
http://aura.gsfc.nasa.gov

Ozone garden information:
http://handsontheland.org/monitoring/projects/ozone/ozone_bio_search.cfm

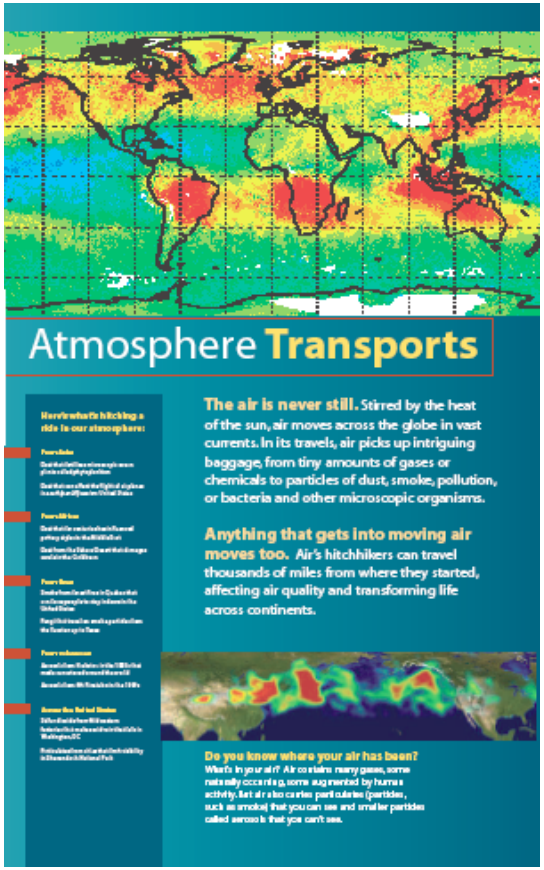
LG-2006-X-XXX-GSFC

Smithsonian NMNH Exhibit

"Atmosphere: Change is in the Air"

The exhibit answers three main questions:

- ***What is the atmosphere?***
- ***How is the atmosphere important to our lives?***
- ***How do we study the atmosphere?***



Includes

- **Milky Way zoom-in to Smithsonian on Washington Mall**
- **Aura 1/8 model**
- **TOMS Engineering Model**
- **Antarctic Ozone Hole Movie 1996-2004 (TOMS+OMI)**
- **Cartoon illustrating reactivity of O_2 and O_3**
- **Interactive: Earth with Low, Existing, High O_2, O_3, CO_2**

Future Plans

- **Create traveling exhibit**
- **Use existing multimedia in GSFC Visitor Center and on virtual exhibit website**

Working with Small Museums

Earth Explorer Institutes "Earth by Aura: Ultraviolet Radiation Data Collection By and For the Public"

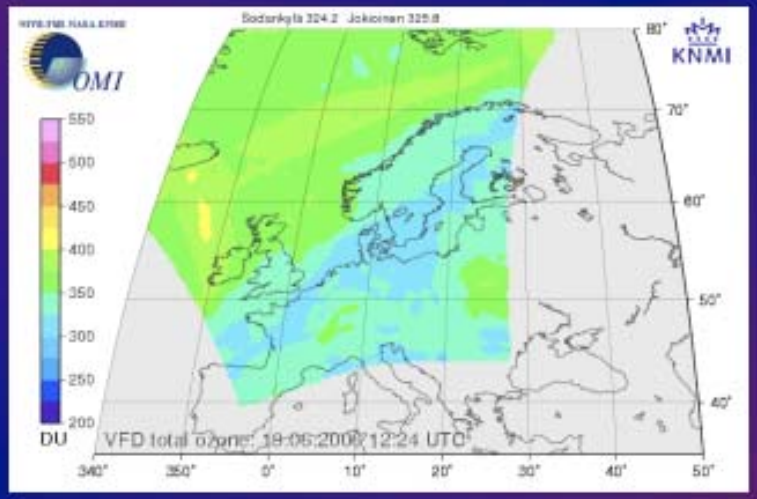
- **Funded through NASA Education Office and NASA Earth Sciences**
- **Includes Maryland Science Center in Baltimore and Bishop Museum in Honolulu**
- **Project materials will be shared by other Museums in the EEI network**

Very Fast Delivery Products of OMI

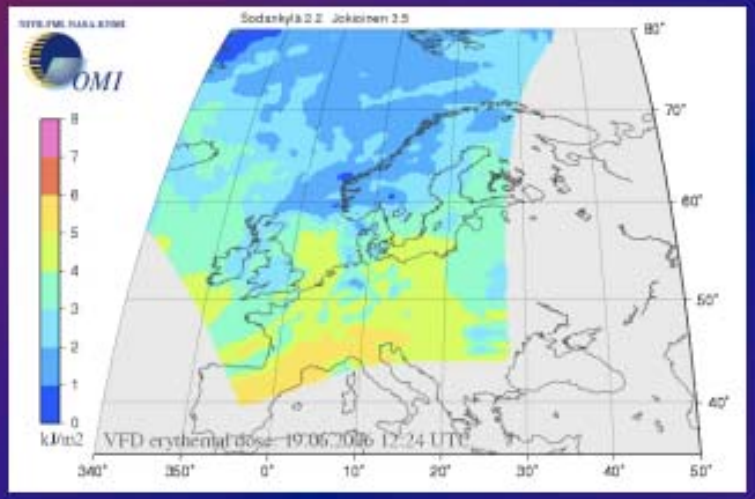
FMI Direct Broadcast

Products for the Public

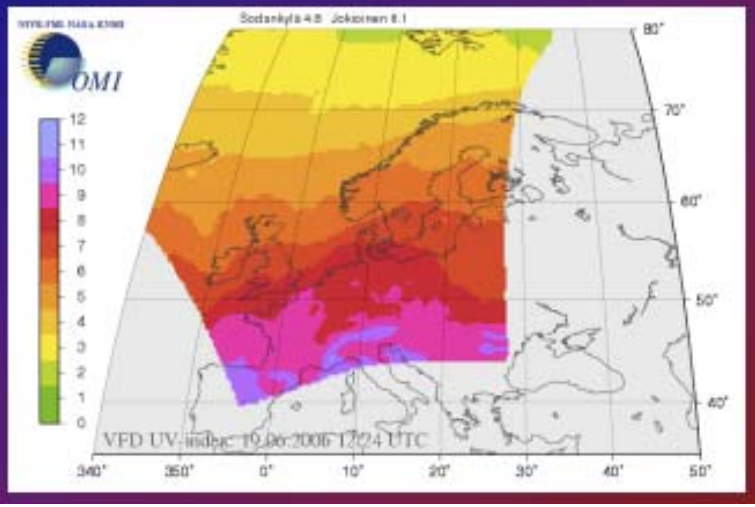
Total ozone



Erythemal daily dose



UV index



http://omivfd.fmi.fi/index_eng.html

Very Fast Delivery Products of OMI

When to use DB?

- Interest in local conditions <- No global coverage
- Qualitative usage <- No scientific accuracy
- Fast availability, regular time coverage
- Fast decisions required
- Interests of general public

Limitations of the Direct Broadcast?

- Configuration files and LU tables are not always up to date
- Dumping of the memory to the ground station
- Limited visibility of the satellite
- Smooth data flow required (every day, operational usage)
- Short processing time required <- fast computers?

What's Next? Additional Post Launch Activities

- **Articles for Earth Observatory including validation campaigns**
- **Aura Science and Validation results brochure**
- **Aura Poster**
- **Aura Involvement in IPY**
- **Education Component for 2007 Aura Validation Campaign**